

CLAIMS

1. A field effect transistor comprising: a semiconductor layer through which carriers injected from a source region travel toward a drain region, the semiconductor layer being formed from a composite material comprising an organic semiconductor material and nanotubes.

2. The field effect transistor according to claim 1, wherein the nanotubes are circumferentially coated with the organic semiconductor material in the semiconductor layer.

3. The field effect transistor according to claim 1, wherein plural ones of the nanotubes are joined with each other in the semiconductor layer.

4. The field effect transistor according to claim 3, wherein the plural ones of the nanotubes are joined with each other by chemical bond in the semiconductor layer.

5. The field effect transistor according to claim 3, wherein a joint portion between the joined nanotubes is coated with the organic semiconductor material in the semiconductor layer.

6. The field effect transistor according to claim 1, wherein the nanotubes are carbon nanotubes.

7. The field effect transistor according to claim 1, wherein the organic semiconductor material is a polymer-type organic semiconductor material.

8. The field effect transistor according to claim 7,

wherein the polymer-type organic semiconductor material is a thiophene-type material.

9. The field effect transistor according to claim 1, wherein the organic semiconductor material is a low-molecular-weight organic semiconductor material.

10. The field effect transistor according to claim 9, wherein the low-molecular-weight organic semiconductor material is an acene-type material.

11. The field effect transistor according to claim 1, wherein the nanotubes are substantially oriented in a predetermined direction in the semiconductor layer.

12. The field effect transistor according to claim 1, which is a thin film transistor.

13. The field effect transistor according to claim 1, which is formed on a substrate.

14. The field effect transistor according to claim 13, wherein the substrate is a plastic sheet or a resin film.

15. A method of fabricating a field effect transistor having a semiconductor layer through which carriers injected from a source region travel toward a drain region, the method comprising the steps of:

(a) providing a composite material comprising an organic semiconductor material and nanotubes; and
(b) forming the semiconductor layer with use of the composite material.

16. The method according to claim 15, wherein the

step (a) includes a process of preparing the composite material by mixing the organic semiconductor material with the nanotubes.

17. The method according to claim 16, wherein:
5 the composite material is prepared by mixing the nanotubes with a solution of the organic semiconductor material in the step (a); and

the semiconductor layer is formed by drying the composite material in the step (b).

10 18. The method according to claim 15, wherein the composite material is prepared to comprise the nanotubes coated with the organic semiconductor material in the step (a).

19. The method according to claim 18, wherein the composite material is prepared by repeating a process
15 including immersing the nanotubes into the solution of the organic semiconductor material and filtering the resulting mixture.

20. The method according to claim 15, wherein the nanotubes are carbon nanotubes.

20 21. The method according to claim 15, wherein the nanotubes used in the step (a) include plural ones joined with each other.

22. The method according to claim 21, further comprising, prior to the step (a), the step (c) of joining the
25 plural ones of the nanotubes with each other.

23. The method according to claim 22, wherein the

plural ones of the nanotubes are joined with each other by chemical bonding in the step (c).

24. An active-matrix display comprising a plurality of field effect transistors as recited in any one of claims 1
5 to 14 which are disposed as switching devices for driving pixels.

25. A wireless ID tag comprising a field effect transistor as recited in any one of claims 1 to 14 which is used as a semiconductor device for forming an integrated
10 circuit.

26. Portable equipment comprising a field effect transistor as recited in any one of claims 1 to 14 which is used as a semiconductor device for forming an integrated
circuit.